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A Linear Programming Analysis of the Regulatory Response of Rural Banks in The Philippines

By

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Abstract

The Philippine government through the Central Bank has tried to influence the rural banks' allocation of funds in favor of small farmer loans through changes in regulatory policy. A linear programming model was developed to evaluate changes in the small farm loan portfolio resulting from selected regulatory changes. Results indicate that neither seed funds to support supervised credit programs nor preferential interest rates on rediscount funds for agricultural loans increase the flow of credit to small farmers. Such policies discourage banks from mobilizing local deposits and increase their dependence on Central Bank rediscount funds. A comprehensive rural financial market reform that eliminates negative real rates of interest and promotes the financial independence of rural banks is needed to increase the flow of credit to small farmers.

Key Words: Philippines, small-farmer credit, rural banks, linear programming, rural financial markets

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Introduction

An increase in the supply of institutional credit to the agricultural sector, particularly the food sector which is dominated by the small farmers, has been one of the policy instruments adopted by The Philippine government during the last two and a half decades to achieve the twin goals of increased agricultural productivity and equitable income distribution. The most well known of these programs is the Masagana 99 (M99) program launched in 1973 to achieve self-sufficiency in rice production. M99 integrated under one umbrella low cost production credit as a vehicle for income transfers to small rice farmers, a fertilizer subsidy, price support, technical assistance and other agricultural support services [Esguerra]. In addition, the government, through the Central Bank (CB), initiated the development of the rural banking system. The CB provided tremendous technical and financial support to ensure the viability and success of the rural banks. At the same time, it has tried to influence the rural banks' allocation of funds in favor of small farmer loans through changes in the regulatory policies. No previous study has been conducted to analyze the effects of those policies on the allocative behavior of banks.

The objectives of the present study are: (1) to determine the profit-maximizing level of small farm loans of a rural bank, given the available

alternative assets, internal operating constraints, regulatory policies of the CB and other external constraints, and (2) to evaluate the changes in the small farm loan portfolio of the bank resulting from changes in selected regulatory policies.

The Analytical Approach of the Study

Linear programming (LP) is the analytical approach employed to achieve the objectives of this study. The assumption of profit maximization for the bank and the linearity of all the constraints facing the bank suggest the suitability of the LP technique for the present study.

A multi-period model is developed in this study. More than one period is included to avoid sub-optimal decisions which might result from a myopic view that ignores the relevant aspects of the future. The bank is assumed to have a one-year planning horizon that is partitioned into twelve monthly planning periods. The choice of the monthly planning periods was dictated in large part by the fact that rural banks are required by the CB to submit monthly financial statements used to determine the banks' compliance with the regulatory constraints imposed on them.

The general form of the LP model estimated in this study is presented below:

$$\text{Maximize } \pi = \sum_{t=1}^{12} \left(\sum_{i} r_i A_{i,t} - \sum_{j} C_j L_{j,t} - FC_t \right)$$

$$\text{subject to: } R_{kt} \left(A_{i,t} - L_{j,t} \right) \leq \beta_{kt}$$

where π = Expected net profit during the planning horizon.

r_i = expected net return on asset i.

C_j = expected cost of liability j.

$A_{i,t}$, $L_{j,t}$ = average stock of asset i and liability j, respectively, during period t.

R_{kt} = coefficient matrix for individual asset and liability accounts associated with constraints K at time t. (K = 1,.....n; n = number of constraints).

β_{kt} = vector of stipulations associated with constraints k at time t.

FC_t = fixed costs at time t.

As formulated above, the maximization of the monthly flows of net profit or income is the objective function used in the model. This is equivalent to the maximization of the return on stockholders' equity (ROE) at the start of the planning period since it is assumed that there is no capital expansion through the sale of new shares of stock; i.e., reinvestment of profits is the only source of additional capital in the model.

As Cohen and Hammer report, there are alternative choices for consideration in the specification of the objective function to use in a bank behavior model: 1) maximize the value of the stockholder's equity during the final period of the planning horizon; 2) maximize the present value of the net income stream plus realized capital gains (and losses) during the planning horizon; and 3) maximize the present values of the net income stream plus realized capital gains (and losses) during the planning horizon plus the present value of the stockholders' equity during the final period of the planning horizon. Obviously, these choices are more appropriate for banks whose capital stocks are being traded in the stock market, as in the case of large commercial banks. This is not the case, however, for rural banks in The Philippines. These banks are closely held corporations and although the sale of new stocks and stock transfers is allowed, these transactions are regulated by the CB. In practice, a majority of the stock transfers and new stock sales are transacted among the existing stockholders and their families.

In contrast to the above specifications of the objective function which are in terms of present value, the objective function for the rural banks in our model is in terms of current value to avoid the difficulties associated with choosing the proper discount rate; except in the case of medium and long-term loans which account for a very small share of Philippine rural bank loan portfolios, all the asset activities in the model have maturities of less than one year. Also, interest income is assumed to be deducted in advance for all loans. Hence, the problem introduced by not using present value originates mainly from the differences in the monthly repayment flows among the loan variables.

The Constraints in the LP Model

The profit-maximizing goal of the bank is restricted by three categories of constraints; those imposed on it by the regulatory authorities, the regulatory constraints; those which are related to the market, the market constraint; and a funds-availability constraint used merely to specify that total uses of funds equal total funds available.

Regulatory Constraints[1/]

1. Reserve Requirement. The required reserve is 14 percent on demand deposits and 8 percent on time and savings deposits. At least 10 percent of the total required reserves shall be in the form of cash deposited with the CB. The balance of the required reserves may be held in the form of vault cash and/or CB-supported securities. However, the holding of securities eligible as reserves cannot exceed 18 percent of the total required reserves (or 20 percent of the maximum 90 percent allowable reserves held in the form of CB-supported securities and/or cash in vault).

2. Risk-Asset Ratio. By regulation, a rural bank must maintain a risk-asset ratio of not less than 10 percent. This ratio is computed by dividing total assets less risk-free assets by capital funds. Risk free assets include cash on hand and due from banks, CB-supported securities, loans secured by deposits, bank premises, furniture, fixtures and equipment and supervised credit loans covered by guarantee.

3. Operating Capital Ratio. The bank's operating capital must be less than 50 percent of the paid-up common capital stock or 40 percent of total deposit liabilities (exclusive of special deposits) whichever is higher.

4. Past-Due Loan Ratio. The ratio of past-due loans to the total loans outstanding of the bank cannot exceed 25 percent if the bank is to avail itself of the special rediscounting privilege with the CB as well as other privileges. Excluded from past-due computation are loans covered by guarantee and M-99 loans in litigation (since M-99 loans are most likely to be covered by guarantee, guaranteed loans must be excluded to avoid double counting).

5. Rediscounting Constraint. There is a ceiling on the amount of loans that rural banks can rediscount with the CB. The ceiling depends on whether the loans are supervised or not. For supervised loans, the rediscounting limit is 400 percent of net worth plus 100 percent of monthly average savings and time deposits (STD) during the three months immediately preceding the date of rediscount application. The corresponding figures for non-supervised loans are 200 percent of net worth plus 50 percent of monthly average STD. All of the outstanding balance on supervised loan papers can be rediscounted with the CB, but only 80 percent on loans that are not supervised can be discounted. Only loans with original maturities of less than one year are rediscountable.

Market Constraints

1. Loans. In the model it is assumed that the bank will not lend more than is forecast in any loan category during any period. This implies that banks are passive rather than active market participants openly seeking borrowers. In the context of the rural financial market in The Philippines where excess loan demand is generally assumed because of low, even negative, real rates of interest on loans, this passive attitude of the banks seems logical. There is no need for banks to compete for loans in general. However, for certain loans, specifically those with low default risks, some degree of competition may be present depending on the structure of the market. Therefore, the forecast should be linked to a certain level of loan risk. Beyond this forecast, the bank is restricted by risk considerations from further lending and hence, will simply say "no" to particular loan requests or otherwise assume a passive attitude towards the market. There is a real need to specify the market limits on loans in the model. Since it is likely that net rates of return among types of loans would differ, the model operates such that, ceteris paribus, all the available funds will be channeled into loans offering the highest return.

2. Investments. Except for equity investments, there are no market constraints on the amount of new investments a bank can make during each period. It is assumed that the supply of government securities and money market instruments is infinitely elastic. Equity investments are regulated very strictly by the CB and for our purposes they can be assumed to be zero. Of course, the reduction or sale of investment assets is constrained by the initial amount available.

3. Deposit Variables. As in the case of loans the increase in deposit variables is limited to the forecast levels during the period. The variables are measured in terms of net monthly balance so there is no need to include another set of variables to represent withdrawals, new accounts, interest credits, et cetera, in the model.

Intertemporal relationships are of prime importance in a multi-period model since they express the interdependence of variables over time. This is particularly true with respect to the maturity of the accounts, and hence, the associated liquidity flows. In addition to maturity flows, an autonomous flow variable is associated with each account at each time period. When the flow is positive, the account is accumulating when the flow is negative, the account is being depleted.

Asset and liability flows are assumed to take place at constant rates during the period. Under this assumption, purchases, sales, and maturations of assets are presumed to occur at constant rates during the period and hence the rate of change in the stocks of the balance sheet accounts themselves will be constant over time. The advantage of this assumption is that the average stock of an account during a period can be defined simply as the arithmetic mean of the initial balance and the end-of-period balance.

Default risks on each loan are assumed to be independent, and default risks across types of loans are also assumed independent. Default risk on the bank's investment portfolio, primarily national government bonds and Central Bank Certificates of Indebtedness, is assumed to be zero.

Determination and Selection of Sample Banks

This study was limited to banks operating in the Central Luzon region of

The Philippines. A large proportion of the small farmers in the country are located in this region, and it has been a hot bed of social and political unrest in the country. The economic plight of the small farmers in this region has consistently been accorded top priority in the government's agricultural development programs. Since the analytical thrust of the study is the identification of changes in CB policies needed to influence rural bank credit allocation in favor of the small farmers, the choice of this region as the study area is logical.

A sample of fifteen banks was included in the study. This constitutes over 10 percent of the rural bank population in the region (exclusive of those banks three years old and less). It is difficult to establish just how representative the sample of banks is of the population considered in the study. Certain elements of non-randomness may have been present in selecting the individual sample banks. Because of the confidentiality of bank information, the identification of sample banks was left entirely to the CB Agricultural Credit Supervisors (ACS) assigned to the region.

After distributing the 15 banks among the six provinces in the region, more or less in proportion to the number of rural banks operating for more than three years, the ACS were requested to identify randomly the banks to be included in the sample. One condition made in the sample selection was that the selected banks should have assets which are no more than P30 million nor less than P4 million to prevent extremely small and large banks from introducing significant bias in the sample.[2/] Data needed for the LP model were gathered through the use of a structured and pretested questionnaire.

In terms of total assets, the average size of the 15 sample banks covered in the study was P10,404,207 as of October 31, 1979 (Table 1). The size

Table 1: The Average Balance Sheet Characteristics of the Fifteen Sample Rural Banks as of October 31, 1979, Central Luzon, The Philippines

Assets	
Cash and Due from Banks:	
Cash on Hand (CH_0)[a/]	P 106,424
Due from CB (CCB_0)	98,996
Due from other banks (COB_0)	687,534
	892,955
Loans and Discounts	
Small-supervised agriculture loan (SSL_0)	2,015,608
Small-ordinary agriculture loan (SOL_0)	1,038,108
Large-supervised agriculture loan (LSL_0)	2,511,297
Large-ordinary agriculture loan ($LOAL_0$)	1,887,502
Medium-and-long-term agriculture loan (MLL_0)	370,596
Commercial loan ($COML_0$)	524,392
Industrial loan (INL_0)	249,107
Other loan (OL_0)	164,933
Less: Allowance for probable losses	(238,455)
Net Loans and Discounts	8,523,090
Investments:	
CB Certificate of Indebtedness -	
reserve eligible ($ERES_0$)	56,486
non-reserve eligible ($XRES_0$)	89,527
Preferred stock redemption (PSR_0)	8,110
Agrarian Reform Credits (ARC_0)	35,881
Other Assets:	
Bank premises (BPREM)	156,265
Furniture, fixtures and equipment (FFE)	79,990
Other bank assets (OBA)	
TOTAL ASSETS	P10,404,207
Liabilities	
Reserve Deposits:	
Demand deposits (DD_0)	7,748
Savings deposits (SD_0)	2,327,666
Time deposits (TD_0)	1,581,454
Non-Reserve Deposits:	
Special time deposits (STD_0)	712,294
Barrio Guarantee Fund (BGF_0)	21,715
Barrio Savings Fund (BSF_0)	78,769
Special Savings Deposits ($SSDC_0$)	95,269

Table 1 continued

Liabilities	
Bills Payable:	
Rediscountingsupervised ($REDS_0$)	2,783,228
Rediscounting-ordinary ($REDO_0$)	570,499
CB-IBRD ($IBRD_0$)	361,832
Other Bills Payable (OBIL)[b/]	71,018
Other Liabilities ($OLIAB_0$)	620,921
Capital Accounts (CAP_0)	1,171,787
TOTAL LIABILITIES[c/]	P10,404,207

Source: Vergara

a/ The subscript of zero (0) indicates that the figure opposite the balance sheet variable serves as the initial values of these variables during the first programming period.

b/ Restructured borrowings from the CB.

c/ The exchange rate in October of 1979 was about P9.50 per U.S. dollar.

varies from P4,194,084 to P22,108,270 and the banks are distributed with eight banks above the average and seven below it. The average sample bank has 84 percent of its total assets in the loan portfolio, 89 percent of which is agricultural credit. Deposit liabilities constitute 38 percent of the total liabilities (including capital) of the average sample bank. Borrowings from the CB account for 36 percent of the total liabilities and almost 89 percent of which is in the form of rediscounting. The total capital accounts of the average sample bank stood at P1,171,787 about 11 percent of total assets. More than 45 percent of the capital is in common stocks and almost 52 percent is in undivided profits and surplus accounts. Preferred stocks account for the balance.

Table 2 shows the expected net returns on assets and the total cost of liabilities of the sample rural banks, including the estimated administrative costs and the risk of default losses of different classes of assets and liabilities. As expected, small supervised agricultural loans (SSL) have the highest administrative costs, 1.56 percent, followed closely by small ordinary agricultural loans (SOL), 1.54 percent. Large supervised (LSL) and large ordinary agricultural loans (LOAL) involve much less administrative costs, 0.98 percent and 0.96 percent, respectively. Medium and long-term agricultural loans (MLL) have the highest estimated of default risk, 4.3 percent, followed by SSL with 3.3 percent.

Results

The LP bank model was solved using the average balance sheet conditions of the sample banks as of October 31, 1979. Three versions of the basic model were also solved to evaluate the impact of changes in the regulatory policies.

Table 2: The Expected Net Returns on Assets and the Total Costs of Liabilities of the Sample Rural Banks, Central Luzon, The Philippines, November 1979 - October 1980

Item[a]	Nominal Return (1)	Service Charge (2)	Administrative Costs (3)	Risk of Default Loss (4)	Net Return[b] (Total Cost) (5)
			Percent per annum		
Assets					
SSL	10.71	2.00	1.56	3.32	7.83
LSL	10.71	2.00	.98	2.85	8.88
SOL	10.71	3.00	1.54	2.38	9.79
LOAL	10.71	3.00	.96	2.79	9.96
MLL	12.50	3.00	1.91	4.36	9.23
COML	10.71	3.00	2.47	3.14	8.10
INL	10.71	3.00	1.52	.68	11.51
OL	10.71	3.00	.003	.94	12.77
CCB	3.0	0.00	0.00	0.00	3.00
XRES	3.0	0.00	0.00	0.00	3.00
ERES	10.32[c]	0.00	0.00	0.00	10.23
PSR	10.32	0.00	0.00	0.00	10.23
ARC	10.32	0.00	0.00	0.00	10.23
Liabilities					
SD	9.50		1.00		10.50
TD	13.50		.59		14.09
STD	3.00		.25		3.25
BGF	9.50		1.41		10.91
BSF	0.50		.46		9.96
SSDC	0.0		1.27		1.27
REDS	1.0		.35		1.35
REDO	3.0[d]		.99		3.99
IBRD	9.0		.58		9.58
OBIL	0.0		1.53		1.53
OLIAB	0.0		.20		.20

Source: Vergara

a/ See Table 1 for a definition of the variables.

b/ Net return on asset equals (1 + 2) - (3 + 4) and total costs of liability equals 1 + 3.

c/ The computed average rate of return on securities is 9.875% per annum. Since the return is tax-exempt and the average bank is at a 4.31% tax bracket, the before-tax return equals 10.34%.

d/ The rediscount interest rate on commercial and industrial papers is 4% per year.

The first version incorporated a parameterized increase of 50 percent over the original loan demands used in the basic model to deal with the uncertainties associated with the demand forecasts.[3/] The second version analyzed the impact of the suspension of special time deposits as a seed fund to support the supervised credit program of the rural banks. The third version examined how equalizing the interest rates on rediscount funds for supervised agricultural loans and ordinary agricultural loans (1 percent and 3 percent, respectively) with that on commercial and industrial loans (4 percent), affected the allocation of funds among different types of loans. Due to the size and complexity of the model, Table 3 contains results only for selected variables pertinent to this study, and only year-end balances or total yearly results are included. In total, monthly and yearly results were included for 65 variables [Vergara].

A gross profit of P422,220 was optimally obtained from the basic model. Adjusting this for the other operating expenses and other income throughout the programming periods resulted in actual net profit (P) of P213,177 (Table 3). This represents the sum of all the period net profits and translates into an optimal return on equity (ROE) to stockholders of 16.68 percent. The actual ROE estimated for the previous year was 22 percent but unlike the model's ROE, actual reported profit is not adjusted for default risk.

The model solution values for the liquid asset varibles, i.e., cash on hand (COH), due from Central Bank (CCB), and due from other banks (COB), provide a good example of profit-motivated compositional shift in the balance sheet of the bank. Except for the first period when COB has a value of P14,795, the liquid assets of the bank are totally in the form of CCB. Under actual operating conditions, a certain amount of non-earning liquid assets,

Table 3: Optimal Solution Values of the Structural Variables in the Basic Rural Bank LP Model and Three Alternative Versions, Central Luzon, Philippines, 1980.

Variables[a/]	Base Model		Version No. 1 A 50% Increase in Loan Demand		Version No. 2 Elimination of Special Time Deposit Seed Fund		Version No. 3 Equalization of Interest Rates on Rediscount Funds	
	Period 12	Total	Period 12	Total	Period 12	Total	Period 12	Total
	- - - - - - - - - - - - P 000 - - - - - - - - - - - -							
ICCB							217.4	
CCB	807.5		783.4		783.4		1,000.7	
COB		2,398.6						
SSLC	145.5		218.2	3,747.9	145.5	2,197.6	145.5	
SSL	1,919.7		2,694.1		1,900.3		1,919.7	
SOLC	67.4	1,180.7	101.1	1,771.0	67.4	1,180.7	67.4	1,180.7
SOL	1,003.5		1,441.9		1,003.5		1,003.5	
LSLC	196.1	3,436.6	294.2	5,154.9	196.1	3,436.6	196.1	3,436.6
LSL	2,854.2		4,010.5		2,854.2		2,854.2	
LOLC	128.9	2,259.1	193.4	3,388.7	128.9	2,259.1	128.9	2,259.1
LOAL	2,065.1		2,925.7		2,065.1		2,065.1	
MLLC	39.7	476.6	39.7	476.6	39.7	476.6	39.7	476.6
MLL	847.2		847.2		847.2		847.2	
COMLC	81.5	978.6	81.5	978.6	81.5	978.6	81.5	978.6
COML	608.5		608.5		607.1		608.5	
INLC	46.1	553.4	46.1	553.4	46.1	553.4	46.1	553.4
INL	429.9		429.9		429.9		429.9	
OLC	29.5	345.9	29.5	345.9	29.5	345.9	29.5	345.9
OL	242.1		242.1		242.1		242.1	
XRESC	111.9		43.4		69.3			
XRES	111.9		43.4		654.0			
ERES	56.5		56.5		56.5		56.5	
ARC	997.0		1,320.00		994.9		997.0	
SDC	34.4	355.4	34.4	355.4	34.4	355.4	34.4	355.4
SD	2,683.0		2,683.0		2,683.0		2,683.0	
TDC	74.7	512.4	74.7	512.4	74.7	512.4	74.7	512.4
TD	1,226.1		1,226.1		1,226.1		1,226.1	

Table 3 continued

Variables[a/]	Base Model		Version No. 1 A 50% Increase in Loan Demand		Version No. 2 Elimination of Special Time Deposit Seed Fund		Version No. 3 Equalization of Interest Rates on Rediscount Funds	
	Period 12	Total	Period 12	Total	Period 12	Total	Period 12	Total
	- - - - - - - - - - - - P 000 - - - - - - - - - - - -							
BGFC	0.7		0.7		0.7		0.7	
BGF	7.5		7.5		8.2		7.5	
BSF	78.8		78.8		78.8		78.8	
SSDC	157.1		235.7		157.1		157.1	
SREDSC		2,352.1		3,527.6		2,052.1		2,143.3
SREDS	1,316.5		1,974.8					
LREDSC		3,240.5		4,860.7		3,240.5		3,118.9
LREDS	2,000.7		3,001.1					
SREDOC		425.7		1,046.6		511.9		
SREDO	135.4		611.1					
LREDOC		612.7		1,488.4		998.2	776.8	
LREDO	57.1		655.1					
CREDOC		167.9		260.9		256.7	260.9	
IREDOC		73.8		119.9		184.4	147.6	
IBRDC	35.3	423.7	35.3	423.7	35.3	423.7	35.3	423.7
IBRD	569.0		569.0		569.0		569.0	
OLIABC	41.9	404.6	42.0		42.0		42.0	404.6
OLIAB	1,025.5		1,025.5		1,025.5		1,025.5	
UI	394.7		546.8		394.7		394.7	
APL	387.4		380.4		286.7		287.4	
P	16.6	213.1	37.3	363.8	15.7	178.6	15.4	157.7
CAP	1,384.9		1,536.1		1,350.4		1,329.5	

Source: Vergara

a/ See Appendix A for definition of variables.

COH and COB, are normally maintained. Thus, the non-risk adjusted ROE is expected to be higher than that obtained under actual conditions.

Liquid assets remained relatively constant throughout the year at P783,374. This represents exactly 20 percent of the deposit liabilities with required reserves, i.e., savings deposits (SD), time deposits (TD), and demand deposits (DD). This percentage exactly matches the recommended primary reserves ratio of 20 percent which was imposed on the model.

An optimal total year-end loan portfolio amounting to P9,970,253 was generated by the model (Table 3). This represents the sum of the 12th period solution values of the outstanding loan variables: SSL, SOL, LSL, LOAL, MLL, COML, INL, and OL. Short term agricultural loans, SSL, SOL, LSL, and LOAL account for 79 percent of the portfolio. Small farm loans, SSL and SOL, contributed 29 percent of the portfolio.

New loans granted, SSLC, SOLC, LSLC, LOLC, MLLC, COMLC, INLC, and OLC, throughout the programming periods summed to P11,729,642. This exceeds the total loan portfolio outstanding at the end of the final period since the latter is already net of matured loans that were repaid. More than 31 percent of the new loans granted are in small farm loans (SSLC and SOLC). For all loan classes, the levels of new loans are at the market limits. As long as the net revenue on loans is higher than the cost of funds rural banks will maximize their profits by granting loans up to the market limits as long as funds are not limiting. As the results indicate, funds availability, particularly the CB rediscount funds, are far from becoming effective constraints on lending.

The outstanding year-end investment portfolio equalled P1,061,622, inclusive of the investment in preferred stock redemption of P8,110 which was

assumed constant during the programming periods. The increase in the investment portfolio originates solely from increases in the investments in Agrarian Reform Credits (ARC).[4/] Starting with an initial level of only P383,711 during the first period, this type of investment rose to P997,025 at the end of the final period.

An optimal mix of current liabilities heavily concentrated in rediscount borrowings (P5,592,628 in rediscounted supervised agricultural loans and P1,280,053 in rediscounted ordinary loans) was generated by the basic model. This fund accounts for almost 59 percent of the total loans granted throughout the 12 periods. There was a net increase of only P355,358 in savings deposits (SDC) which was almost exactly offset by a decrease in time deposits. New time deposits (TDC) totalled P512,386 but this was exceeded by the maturation of the old time deposits outstanding at the beginning of the first period. Since time deposits are the most expensive source of funds in the model and, except for other liabilities (OLIAB), rediscounting of supervised loans is the least expensive, these results were expected. These results suggest that rural banks cannot be expected to mobilize funds in rural areas as long as cheaper sources of funds are available from rediscount lines from the CB.

Basic Model Version I: Increase in Loan Demand Forecast of 50 Percent

In this version, it is assumed that excess demand may exist only in the case of short-term agricultural loans. Since an exact measure of the excess demand is not possible, the loan demand forecast used in the basic model was parameterized in 10 percent intervals to a maximum of 50 percent above the base loan demand. The optimal solution indicates that the net profit (P) increased to P363,800 with a 50 percent increase in loan demand. Evidently, without the market restrictions on loan demand, the profit and ROE will

increase to an unrealistically high level that will be constrained only by the available funds. The bank's portfolio is specialized in loan types that have the highest net return which shows how the profit contribution of a cheap rediscounting policy is so directly linked to, and constrained by, the demand for loans.

It is obvious that in the absence of market restrictions on loans, the rate of return a rural bank can obtain with rediscounting will only be constrained by the maximum limit on rediscounting. A profit-maximizing bank will arbitrage indefinitely, granting rediscountable loans, rediscounting them, and using the proceeds to make further loans until the limits on rediscount funds are reached. This, of course, assumes that the net return on rediscountable loans is invariant with the volume of loans supplied and that it is higher than the rate of discount. Since the nominal rate of return and the administrative costs are assumed constant, this is equivalent to assuming that the default risk on loans is also invariant with the supply of loans; however, a positive correlation exists between risk and the amount of loans. As the risk increases to the point where the estimated net return on rediscountable loans become equal to or less than the rate of discount, the optimal supply of rediscountable loans will be determined. Which of the alternative loan demand forecosts corresponds to this optimum is extremely difficult to determine.

Basic Model Version 2: Suspension of special time deposits (STD) as a "seed fund" to support the supervised credit program of the rural banks

To enable the banks to maximize their participation in the CB sponsored supervised credit program, the CB has also been providing the rural banks with

a seed fund in the form of a three month STD at an annual interest of 3 percent. This seed fund is to augment the bank's own liquid funds at the start of the "season" of the program and thus enable it to accommodate as many borrowers as possible whose loans can be rediscounted later with the CB to accommodate future borrowers.

Quite clearly, the overall profitability of rediscounting to the rural bank is limited by the amount of initial funds it has. In the extreme case where the initial fund is zero, the bank will gain nothing from rediscounting as it will not be able to generate new loans to rediscount later.

The results from a model without the STD as a source of funds show that new loans granted during the first period suffered the most. Considering all the periods, however, the increase in new time deposits remains the same as in the original model. Also, the overall effect on the amount of funds allocated to ARC is only P2 thousand less in this model than in the basic model (Table 3). Net profit (P) over the periods is reduced to P178,600. This net profit of the bank without STD is equivalent to a net return of only 12 percent and indicates that bank profits will suffer without STD.

Model Version No. 3: Equalization of the interest rates on various rediscount funds

Currently, on supervised agricultural loans, the interest rate on rediscount funds is set at 1 percent compared to 3 percent on ordinary agricultural loans and 4 percent on commercial and industrial loans. The objective of interest rate differentiation is to increase the profitability of supervised agricultural loans relative to other loans and thus induce the rural banks to allocate more of their funds to supervised loans. However, as discussed earlier, as long as the costs of funds needed to finance the various

types of loans are less than the net rates of returns on loans, differences in the profitability of loans are irrelevant since availability of funds is not an effective constraint. Only the market constraints effectively limit the allocation of funds among the various types of loans. Further reduction in the costs of funds will have no effect on allocation of funds as long as the market constraints remain effective. Conversely, the costs of funds could be increased without affecting the allocation of funds among the various types of loans as long as they are below the net return on certain types of loans.

As an empirical test of the above, the basic model was modified by equalizing the interest rates on rediscount funds with the rate on commercial and industrial loans as the basis. As expected, the allocation of funds among the different types of loans remains constant. Among the asset variables, only ARC and CCD were affected. The intertemporal allocation of funds to ARC changed for some periods but the overall amount of funds allocated did not change. There was, however, a reduction in the amount of liquid assets, CCB_t, held by the bank.

Among the liability items, only the rediscount funds were affected. There was a decrease in supervised rediscounting, i.e., $SREDSC_t$ and $LREDSC_t$ and an increase in ordinary rediscounting, i.e., $LREDOC_t$, $SREDOC_t$, $CREDOC_t$ and $IREDOC_t$. Again this is consistent with profit-maximizing behavior since as their interest rates are equalized, the "price ratio" moves in favor of ordinary rediscounts.

The equalization of discount rates resulted in a profit reduction to P157,500. In a counterfactual sense, the profit reduction from the base model to this model represents the amount by which profit would be increased through

a policy of preferential rediscount rates for agricultural loans. As evidenced by the results, however, this policy could not be expected to lead to an increase in agricultural loans unless the demand for loans increases.

Conclusions and Implications

New policies are needed to increase the flow of credit to small farmers if the goal of a more balanced, stable, and equitable agricultural development is to be pursued. Private rural banks should continue to play a major role and hence, the need to foster the long-run stability and growth of the rural banking system cannot be over emphasized. In this respect, policies to promote the financial independence of rural banks from the Central Bank become very relevant.

A policy suggested by this study is the suspension of special time deposits as a seed fund for financing the supervised credit program. It should be obvious to the rural bank management that the profitability of rediscounting depends on the amount of the initial liquidity it can utilize to generate new rediscountable loans and thereby start the sequential process of rediscounting these loans, making further loans from rediscounting proceeds etc. This seed fund policy only serves as a disincentive to practice sound and efficient liquidity and liability management. More importantly, concessional discounting policies discourage banks from mobilizing local deposits.

Unless there is a significant increase in loan demand in the future, any policy that seeks to shift the composition of the liabilities of the rural banks away from the cheap rediscount funds and STD from the CB toward more expensive deposit liabilities and capital funds can only be expected to lead to reduced profitability for rural banks. Considering the high rate of return that the rural banks expect, this policy may have serious repercussions on the

long-term growth and stability of the rural banking system. There is also the difficult issue concerning the availability of deposit liabilities. Even if a policy could be formulated that would increase the marginal return of additional deposits to the rural banks, the problem is that the rural banks may have very limited opportunities to raise additional deposits in view of the negative real rates of interest paid on them. The interest elasticity of the supply of deposits is still an empirical issue in The Philippines but based on experience in Taiwan and Korea, it can be postulated that an increase in interest rates would increase deposits [Adams]. However, changes in the interest rates on deposits cannnot be considered without at the same time dealing with the interest rate policies on loans.

We suggest that increasing the flow of credit to the small farmers and promoting the financial independence of the rural banks can be achieved by nothing less than a comprehensive rural financial reform that will simultaneously consider policies concerning the costs of various sources of funds (the supply side) and the returns on the alternative uses of funds (the demand side). A single-policy piecemeal approach to financial reform will not likely be adequate and may only lead to unintended undesirable consequences.

Footnotes

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1/ The bank premises ratio and the furniture, fixture and equipment ratio were not included in the model. It was assumed that there will be no purchase and sale of these assets during the programming period.

2/ The exchange rate in October of 1979 was about P9.50 per U.S. dollar.

3/ The loan demand forecasts have been parameterized in such a way that it covers increases of 10%, 20%, 30%, 40% and 50% over the original. However, the solution values do not differ much between 10% and 40% and hence only the results for 50% are presented.

4/ In The Philippines all banking institutions are required to maintain at least 25 percent of the loan portfolio in agricultural loans. At least ten of the 25 percent should be loans to small-farmer beneficiaries of the agrarian reform program. The banks are given the option to meet this requirement by purchasing ARC securities from the CB.

References

Adams, Dale W, "Mobilizing Household Savings Through Rural Financial Markets," Economic Development and Cultural Change. Vol. 26, No. 3, April, 1978, pp. 547-560.

Cohen, K. J. and Hammer, F. S. (eds.), Analytical Methods in Banking. Richard D. Irvin, Inc., Homewood, Illinois, 1966.

Esguerra, Emmanuel F., "An Assessment of the Masagna 99 Credit Subsidy As An Equity Measure," Philippine Review of Economics and Business. Vol. XVIII, Nos. 3 and 4, September and December 1981, pp. 168-191.

International Monetary Fund, "International Financial Statistics," Vol. XXXIII, No. 1, January 1980, pp. 320-321.

Kane, E. J. and Malkiel, B. G., "Bank Portfolio Allocation, Deposit Variability and the Availability Doctrine," Quarterly Journal of Economics, Vol. 79, February, 1965, pp. 113-134.

Vergara, Serverino B., "An Analysis of the Regulatory Response of Rural Banks in The Philippines: A Multiperiod Linear Programming Approach," unpublished Ph.D dissertation, Department of Agricultural Economics and Rural Sociology, The Ohio State University. 1980.

Appendix A: Definition of Selected Structural Variables in The Rural Bank LP Model, Central Luzon, Philippines, 1979-1980

CCB_t - due from Central Bank in period t

$DCCB_t$, $ICCB_t$ - the decrease and the increase, respectively, in CCB

COB_t - due from other banks in period t

$SSLC_t$, SSL_t - (new) supervised small agricultural loans granted and outstanding, respectively

$SOLC_t$, SOL_t - (new) small ordinary agricultural loans granted and outstanding, respectively

$LSLC_t$, LSL_t - (new) large supervised agricultural loans granted and outstanding, respectively

$LOLC_t$, $LOAL_t$ - (new) large ordinary agricultural loans granted and outstanding, respectively

$MLLC_t$, MLL_t - (new) medium and long-term agricultural loans granted and outstanding, respectively

$COMLC_t$, $COML_t$ - (new) commercial loans granted and outstanding, respectively

$INLC_t$, INL_t - (new) industrial loans granted and outstanding, respectively

OLC_t, OL_t - (new) other loans granted and outstanding, respectively

$XRESC_t$, $XRES_t$ - (new) non-reserve eligible securities purchased and outstanding, respectively

$ERESC_t$ $ERES_t$ - (new) reserve-eligible securities purchased and outstanding, respectively

$ARCC_t$, ARC_t - (new) "agrarian reform credits" securities purchased and outstanding, respectively

SDC_t, SD_t - (new) savings deposits and savings deposits outstanding, respectively

TDC_t, TD_t - (new) time deposits and time deposits outstanding, respectively

$STDC_t$, STD_t - (new) special time deposits and special time deposits outstanding, respectively

$BGFC_t$, BGF_t - decrease in Barrio Guarantee Fund (BGF) and BGF outstanding, respectively

$BSFC_t$, BSF_t - increase in Barrio Savings Fund (BSF) and BSF outstanding, respectively

$SSDC_t$ - special savings deposits outstanding

$SREDSC_t$ - $SSLC_t$ rediscounted in period t and become available in period t + 1

$LREDSC_t$ - $LSLC_t$ rediscounted in period t and become available in period t + 1

$SREDOC_t$, $LREDOC_t$, $CREDOC_t$, $IREDOC_t$ - $SOLC_t$, $LOLC_t$, $COMLC_t$ and $INLC_t$ rediscounted, respectively, in period t and become available in period t + 1

$SREDS_t$, $LREDS_t$, $SREDO_t$, $CREDO_t$, $IREDO_t$ - the end-of-period balances of different types of rediscount borrowings (t = 2, ..., 12)

$IBRDC_t$, $IBRD_t$ - (new IBRD and IBRD outstanding, respectively

$OLIABC_t$, $OLIAB_t$ - (new) other liabilities and other liabilities outstanding, respectively

UI_t - unearned interest income for each period

APL_t - allowance for probabe losses for each period

P_t - net profit/income from loans and investents for each period

CAP_t - capital accounts outstanding for each period